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METHODS FOR ANALYZING THE DISRUPTION OF TRACKING,(U)
MAR 82 G V OBREZKOV, V D RAZEVIG
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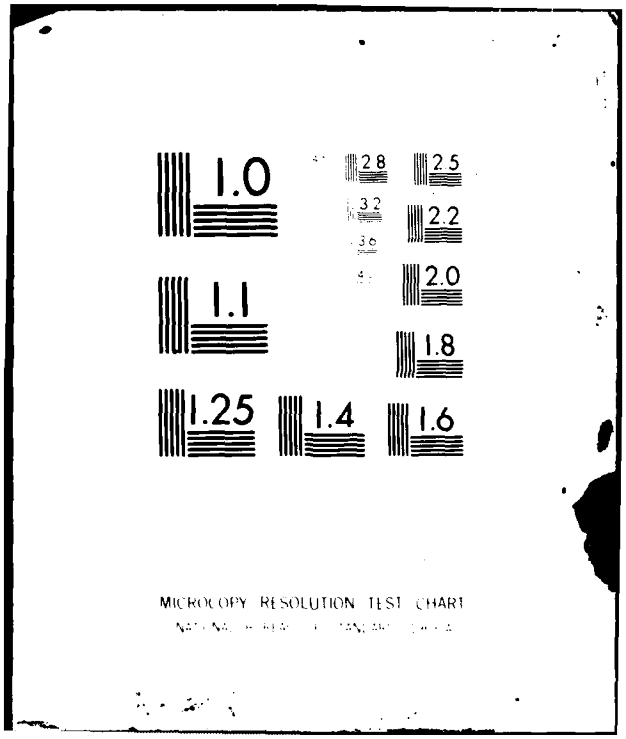
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FOREIGN TECHNOLOGY DIVISION

METHODS FOR ANALYZING THE DISRUPTION OF TRACKING

by

G.V. Obrezkov and V.D. Razevig

Approved for public release;
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EDITED TRANSLATION

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

METHODS FOR ANALYZING THE
DISRUPTION OF TRACKING

G. V. Obrezkov and V. D. Razevig

4. Direction Finders

Devices, which are called direction finders, are used to isolate the information, which pertains to the angular position of a radar target, from a signal. In recent years, the direction finders that are used most extensively are those with an instantaneous comparison of signals. An example of these is a direction finder of the sum-and-difference type, whose simplified functional diagram is shown in Fig. 1.14 for one direction-finding plane.

A signal reflected from a target proceeds simultaneously to two antennas with the radiation patterns $G_1(\varphi)$ and $G_2(\varphi)$ displaced at the angle 2β. A waveguide device, which is at the input of the receiver, forms the sum u_Σ and difference u_Δ voltages which, together with the voltage of the heterodyne G, enter the mixers CM_1 and CM_2. The voltages obtained as a result of conversion are amplified by the stages $UPCh_1$ and $UPCh_2$ and enter the phase discriminator FD. The instantaneous automatic gain control (MARU) is used to normalize the signal being received with respect to amplitude in accordance with the scheme shown in Fig. 1.14. The MARU maintains a constant voltage at the output of the sum channel, while the output voltage of the difference channel changes in inverse proportion to the voltage at the input of the sum channel. The phase detector (FD), while performing the multiplication operation for the input signals, forms a voltage at the output of the direction finder

that is proportional to the ratio of voltages of the difference and sum channels

$$u_{вых} \sim \frac{u_\Delta}{u_\Sigma}. \tag{1.13}$$

As a rule, the calculation of the discrimination and fluctuation characteristics of the direction finders consititutes a very difficult problem since, in this case, it is necessary to analyze a large number of stages of the receiver, including the ncnlinear stages. Not delving into the particulars of this analysis, we note that the discrimination characteristic of this direction finder can be obtained from relation (1.13),

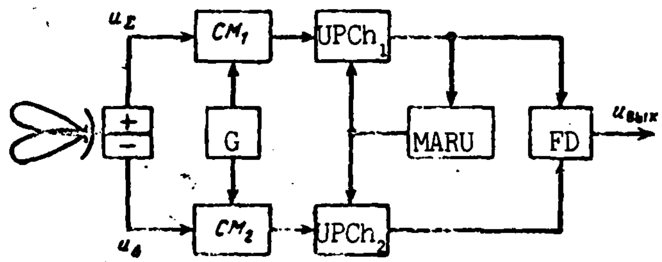

Fig. 1.14. Direction finder of the sum-and -difference type: CM - mixer; G - heterodyne; UPCh - intermediate frequency amplifier; FD - phase detector; MARU - instantaneous automatic gain control.

if we take into account the specific forms of the radiation patterns of the receiver's antennas. Finally, the discrimination characteristic of the direction finder will be defined by the expression

$$F(\theta) = U_0 \frac{G(\theta-\beta) - G(\theta+\beta)}{G(\theta-\beta) + G(\theta+\beta)}, \tag{1.14}$$

where 2β is the angle between the maxima of the radiation patterns; θ - current angle of mismatch between the axis of the equisignal zone and the direction from which the signal arrives; and U_0 - maximum voltage at the output of the phase detector attained during a mismatch $\theta = \pm\beta$.

A more detailed calculation of the discrimination characteristics for different direction finders can be found, for example, in [9]. In this work we will only note the special feature of the discrimination characteristics (Fig. 1.15), consisting in the existance of several points of stable and unstable equilibrium. This is explained by the

presence of side lobes in the radiation patterns of the finder's antennas. The effective segment of the discrimination characteristic, which is the steepest, lies in the vicinity $\theta \sim 0$. It is formed by the main lobes of the radiation patterns. Usually, the level of side lobes of the radiation patterns is 20–40 dB lower than that of the main lobes and, therefore, it can be disregarded in most instances. However, in

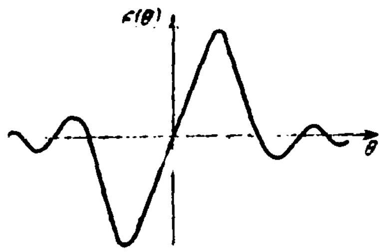

Fig. 1.15. A typical direction-finding characteristic.

certain cases, the target can also be tracked by the side lobes; then, the discrimination characteristic should be considered in the form shown in Fig. 1.15.

Along with the direction finder of this type, one frequently encounters a system with an instantaneous amplitude comparison [9] in which the signal is normalized by logarithmic amplifiers. The calculation of the discrimination and fluctuation characteristics of such a direction finder can be found, for example, in work [106].

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